

III. Remarks

Reconsideration and allowance of the subject application are respectfully requested.

Claims 24-30 are pending in the present application, with Claim 24 being independent. Claims 24 and 26-29 have been amended. All amendments presented herein are made for reasons of clarity with respect to the specification and drawing, and not for reasons relating to the statutory requirements for patentability.

While Applicants specifically traverse the rejection under 35 USC § 112, second paragraph, it is believed that the rejections are mooted by the amendments made to Claims 24 and 26-29.

Claims 24-30 were rejected under 35 U.S.C. § 103(a) as being unpatentable over Trampusch, Settles, Opel, and Swain, for the reasons discussed at pages 3-5 of the Office Action. Applicants respectfully traverse all art rejections.

As the Office Action acknowledges, Trampusch fails to disclose or suggest dry ice granules ranging in size from approximately 0.005 to 0.040 inches in diameter, at a gas-to-dry ice mass ratio ranging from approximately 2.0 to 3.5, and at a gas flow rate ranging from approximately 3 to 50 SCFM. Settles, Opel, and Swain have been cited to remedy the many deficiencies of Trampusch. However, Applicants submit that these secondary references fail to remedy the deficiencies of Trampusch with respect to the presently claimed invention, and further submit there is no motivation to combine any of these secondary references with Trampusch. The rejection under 35 U.S.C. § 103(a) is therefore improper, and Applicants respectfully request that it be withdrawn for the reasons to be set forth below.

Applicants submit that it is *not* obvious that the disclosed mass ratio between the **water ice to cold gas flow** disclosed in Settles has any applicability in a system for accelerating **granules of dry ice in a gas flow**. In particular, Settles' method is concerned with the problem of accelerating liquid water droplets, and it is observed that:

...the inertia of 1000 μm [0.039 inch] droplets can be too great for significant acceleration to occur ... smaller (e.g. approximately 10 [0.00039 inch] and less than 100 μm) droplets follow the fluid velocity closely ... the performance of 100 μm [0.0039 inch] droplets is more modest; these droplets attain only about half the fluid velocity at the nozzle exit. (See col. 5, line 34-43.)

Clearly, Settles teaches away from using large (e.g. 0.0039 inch or greater) droplets by indicating that these droplets are too large to be accelerated so as to achieve a high enough velocity to be useful in an ice-blasting system. The method of Applicants' claimed invention accelerates much larger granules of carbon dioxide that are on average 50% more dense than water or ice droplets. Therefore, Applicants submit that one skilled in the art would not be motivated to combine the disclosure of Trampusch with Settles, as suggested, to arrive at the claimed gas to dry ice mass ratio.

Applicants also respectfully disagree with the conclusion expressed in paragraph 6 of the Office Action that Settles "teaches dry ice" in conjunction with an abrasive cleaning system. In particular, Settles' invention is for a device and method that:

...utilizes a **cryogenic fluid/dry air mixture that interacts with atomized water to form ice crystals**. The crystals are projected through a blast nozzle to be directed at a substrate surface. The ice crystals, of a size range below one hundred micrometers [0.0039 inch], are produced within the apparatus... [emphasis added] (See Abstract of the Invention.)

that is,

The ice is manufactured by producing fine water droplets via atomization and **freezing them by exposing them to a cold gas**. [emphasis added] (See col. 3, line 16.)

Accordingly, Settles teaches away from dry ice cleaning, as is further evidenced by the disclosure that:

...many of the **current techniques first manufacture relatively large particles or pellets of ice or dry ice**, then transport them through a hose to the blast site where they are accelerated through the blast nozzle. [emphasis added] (See col. 2, line 46-49.)

and

The present method thus **eliminates the complex and expensive ice-making and handling systems** required by earlier techniques. [emphasis added] (See col. 3, line 14-16.)

Accordingly, there is nothing in Settles (including the disclosure at col. 1, lines 50-65 and col. 2, lines 45-50, which were referenced in Paragraph 6 of the Office Action) that discloses or suggests that Settles “teaches dry ice”. Quite to the contrary, Settles provides an alternative abrasive cleaning system for the expressed purpose of avoiding perceived shortcomings of the then-known dry ice abrasive cleaning systems.

Applicants further disagree with the observation in the Office Action that it is “notoriously well [known] in the art that cryogenic fluids include for example liquid carbon dioxide which form dry ice.” While it is recognized that pressurized liquid CO₂ changes to snow with expansion to ambient pressure, the snow is not a suitable replacement for dry ice granules in accordance with the method of the present invention. Accordingly, Applicants do not agree that the mere recitation of “cryogenic fluid,” especially when it is clear that Settles is using said fluid to create a cold gas for cooling water, is enough to disclose or otherwise suggest a dry ice granule generator.

Again, Applicants submit that one skilled in the art would not combine the disclosure of Settles with Trampusch.

Applicants also respectfully disagree with the conclusion expressed in the Office Action that those skilled in the art would be motivated to apply the teachings of Swain in the combination suggested. In particular, Swain discloses a process for cleaning delicate substrates such as those used in electronics. The process involves creating an abrasive flow of carbon dioxide snow, with a desired set of properties, directly from liquid carbon dioxide in a sequential method wherein the liquid carbon dioxide passes through a series of expansion chambers, for initial flake formation and agglomeration, before entering into an accelerator that is configured to cause the snowflakes to further agglomerate and accelerate therethrough before being used in a cleaner flow. This method is completely different from that set forth in Trampusch, and one skilled in the art would recognize that the flow rates set forth for use in snowflake agglomeration cleaning systems are inapplicable to systems and methods for cleaning a mold using dry ice pellets.

Specifically, the accelerator of Swain is configured, and operated (i.e. at 14 SCFM flow rate), to cause the flakes exiting the 500-1000 μm small orifice and passing into the large expansion chamber to agglomerate until they are on average 30 times larger than the average size of the flakes exiting the small orifice.

Applicants submit that the claimed dry ice granules of the present invention are **not** analogous to the lower-density snowflakes of Swain. Applicants submit that one skilled in the art, having Trampusch in his possession, would not look to

the snowflake-based cleaning method of Swain to determine an appropriate mass flow ratio for the dry ice pellet cleaning method of Trampusch.


Opel discloses a dry ice **granule** cleaning system that has a low blasting pressure and air flow (and hence has low noise levels), and uses granules having a diameter of 0.015-0.045 inches. Applicants submit that one skilled in the art would not be motivated to combine the disclosure of Trampusch with that of Opel. Trampusch provides a means for configuring a portable **pellet** dry ice blasting system, which characteristically has a high level of noise production because of the large air volumes required, for use in the cleaning of molds without having to resort to costly sound-insulation measures. (See col. 2, lines 33-37.) In particular, the objective of Trampusch is to provide a chamber, configurable between the mold halves, such that the noise is attenuated therein. (See Abstract, and col. 9, lines 8-17.) The pellet dry ice blasting system of Trampusch is modified for high pressure and high air flow, and the unique problems associated with such systems. It is not configured or intended for use with a low pressure, low air flow granule dry ice cleaning system like that disclosed in Opel, and one skilled in the art would therefore not be motivated to combine them.

Therefore, in view of the remarks set forth above, Applicants respectfully submit that there is no motivation for the person of skill in the art to combine the references in the manner proposed. Accordingly, Applicants respectfully request that the prior art rejections be withdrawn.

In view of the above amendments and remarks, it is believed that this application is now in condition for allowance, and a Notice thereof is respectfully requested.

Applicants' undersigned attorney may be reached in our Washington, D.C. office by telephone at (202) 625-3500. All correspondence should continue to be directed to our address given below.

Respectfully submitted,


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